

BPA Energy Efficiency Emerging Technology 2014 Current Research Project			
Focus Area:	Heat Pump Water Heaters		
Technology:	Reverse Cycle Chiller		
Project Name:	Field Test of Reverse-Cycle Chillers in Multi-family Residential Buildings		
Sector(s):	Multi-Family Commercial		
BPA Project Manager:	Kacie Bedney	Partners:	Ecotope
Project Start Time:	6/15/2009	Project End Time:	6/30/2014
Project Energy Savings:	5 aMW	Technology Roadmap:	Commercial and Residential Water Heating
Last Updated: 09/2013			
Project Description:			
<p>The project includes feasibility and design studies followed by demonstration of a large central Reverse Cycle Chiller (RCC) or Heat Pump Water Heaters for energy efficient production of domestic hot water in multifamily residential projects. Feasibility and design studies were completed in 2010. The first installation was completed in November 2012; a second installation will be completed in the Spring 2013. The next phase of the project will include Measurement & Verification of Energy Savings. The project will conclude with a final report of lessons learned and recommendations for future applications of this technology.</p>			
Research Questions:			
<ol style="list-style-type: none"> 1) Quantify the energy savings using a large heat pump water heater (or called RCC) vs. electric resistance domestic hot water in a multifamily (MF) application. 2) Prove this concept. 3) What are the technical challenges associated with integrating this technology into the Multi-Family sector? 4) Is this a good technology for the Multi-Family sector? 			

BPA Energy Efficiency Emerging Technology 2014 Current Research Project			
Focus Area:	Roof Top Units		
Technology:	Advanced Rooftop Controls		
Project Name:	DOE/PNNL Advanced Rooftop Controls Study		
Sector(s):	Commercial		
BPA Project Manager:	Mira Vowles	Partners:	Department of Energy Pacific Northwest National Labs Transformative Wave Technologies
Project Start Time:	5/31/2012	Project End Time:	12/31/2014
Project Energy Savings:	9 aMW	Technology Roadmap:	Heating and Cooling Production and Delivery
Last Updated: 09/2013			
Project Description:			
<p>BPA is working with DOE/PNNL to test the RTU Catalyst unit, a packaged controls technology providing VFD and DCV. Fifty-three (53) sites will be monitored during this project. The work plan includes validating the control package, quantifying the Catalyst savings including breaking out fan savings and comparing the savings to PNNL's modeled savings. BPA is supporting a second year of data collection for the project which began in 2012 with other funders. A final report is expected late in 2013.</p> <p>RTU Catalyst is a product of Transformative Wave Technologies (TWT).</p>			
Research Questions:			
<ol style="list-style-type: none"> 1) What are the potential energy and cost savings of control strategies that can be implemented in a controller, which can be retrofitted on existing packaged heating, ventilation and air-conditioning (HVAC) units to improve their operational performance? 2) What are the contributions of fan and compressor savings? 3) What are the DCV savings contributions? 4) What are the costs and benefits? 5) What are the cost and the barriers for further technology deployment? 6) What are the optimum control sequence and settings? 			

BPA Energy Efficiency Emerging Technology 2014 Current Research Project

Focus Area:	Roof Top Units		
Technology:	Advance Rooftop Controls		
Project Name:	ET Field Test -Transformative Wave Technology (TWT) M&V Contract		
Sector(s):	Commercial		
BPA Project Manager:	Mira Vowles	Partners:	Transformative Wave Technology
Project Start Time:	10/1/2012	Project End Time:	9/30/2014
Project Energy Savings:	9 aMW	Technology Roadmap:	Heating and Cooling Production and Delivery

Last Updated: 09/2013

Project Description:

BPA is supporting an Emerging Technology (ET) field test for up to 75 Premium RTU Retrofits to determine savings associated with these retrofits. This contract supports power metering for one year to evaluate the energy savings for up to 75 retrofits that use the TWT's Catalyst system.

Research Questions:

- 1) What are the savings and cost-effectiveness of ET Field Test installations?
- 2) What measure specification ensures an aggregate, Program-level BCR over 1?
 - a. Is web-enabling necessary?
 - i. Enables M&V
 1. Adding to Catalyst for ex post evaluation?
 2. Work with ED on evaluation plan
 - ii. After a year BPA-funded web-enabling, survey owner regarding value and use?
 - b. What installations weren't cost effective?
- 3) Does M&V verify the savings estimates?
 - a. Is the realization rate greater than 80%?
 - i. No true pre-metering, only simulated baseline metering
 - b. Are there other key variables?
- 4) Can the provisional standard RTU protocol be used to evaluate Premium RTU Retrofit measures?
 - a. Is a fully-commissioned RTU (constructed) baseline acceptable?
 - b. What parameters determine the optimal metering period (weekends, heating season temperatures, etc.)?
 - e. Will we need to do 4-week pre-metering on an RTU sample?
- 5) Is the Catalyst simulated baseline an accurate portrayal of a commissioned RTU?
 - a. Can the energy signature show whether the baseline is properly commissioned?
 - b. Balance point, slope, occupied, unoccupied/schedule

BPA Energy Efficiency Emerging Technology 2014 Current Research Project			
<u>Focus Area:</u>	Variable Capacity Heat Pumps		
<u>Technology:</u>	Ductless Heat Pump		
<u>Project Name:</u>	Ductless Heat Pump – Eclectic Single Family, Manufactured Homes, Multi-Family Small Commercial Applications		
<u>Sector(s):</u>	Residential		
<u>BPA Project Manager:</u>	Kacie Bedney	<u>Partners:</u>	Ecotope
<u>Project Start Time:</u>	8/15/2010	<u>Project End Time:</u>	6/30/2014
<u>Project Energy Savings:</u>	115	<u>Technology Roadmap:</u>	Residential HVAC
Last Updated: 09/2013			
Project Description:			
The project is designed to test the DHP in different applications. Fifty one sites were installed to test different applications including single family, multi-family, manufactured homes and small commercial across different climate zones. As part of the study, one year of data was collected through sub metering; and pre and post billing data was completed and analyzed for each site. Preliminary results have been promising for manufactured homes and single family with forced air furnace applications.			
Research Questions:			
1) What are the savings across the five applications? 2) Do they support pursuit of a future measure?			

BPA Energy Efficiency Emerging Technology 2014 Current Research Project			
Focus Area:	Variable Capacity Heat Pump		
Technology:	Ducted Heat Pump		
Project Name:	VCHP Green Speed Carrier HP Lab Test		
Sector(s):	Residential		
BPA Project Manager:	Kacie Bedney	Partners:	EPRI Tailored Collaborative Study
Project Start Time:	4/15/2012	Project End Time:	12/31/2013
Project Energy Savings:	30 aMW	Technology Roadmap:	Residential HVAC
Last Updated: 09/2013			
Project Description:			
<p>Working in conjunction with EPRI, BPA is performing lab test on the Carrier Green Speed Variable Capacity Heat Pump. The goal is to provide information to enable enhancements to energy simulation models and to develop region-wide energy efficiency incentives for VCHPs used in homes with electric forced-air furnaces and older heat pumps with a HSPF=8.5. The study will also produce performance maps under a variety of climate conditions including heating at low ambient temperatures.</p>			
Research Questions:			
<ol style="list-style-type: none"> 1) Characterize the apparent leap-change in heating performance of this system (HSPF = 13) vs. the federal minimum HSPF = 8.5 2) What is the capacity, power, and efficiency over the range of testing conditions? 3) Does the energy efficiency meet the claims of the manufacturer? 4) What are the reasons behind its substantial improvement over the industry norm? 			

BPA Energy Efficiency Emerging Technology 2014 Current Research Project			
<u>Focus Area:</u>	Variable Capacity Heat Pump		
<u>Technology:</u>	Ducted Heat Pump		
<u>Project Name:</u>	VCHP Green Speed Carrier HP Field Test		
<u>Sector(s):</u>	Residential		
<u>BPA Project Manager:</u>	Kacie Bedney	<u>Partners:</u>	Ecotope
<u>Project Start Time:</u>	1/31/2013	<u>Project End Time:</u>	1/31/2014
<u>Project Energy Savings:</u>	30 aMW	<u>Technology Roadmap:</u>	Residential HVAC
Last Updated: 09/2013			
Project Description:			
<p>The Field Study will have two phases of work; 1) Phase 1 is determining the energy savings at eight installed sites. Phase 2 will estimate the annual savings for each site, determine the incremental savings of this technology compared to two baselines, and provide a workbook for an RTF UES measure if the field, Campbell Creek, and lab studies show it is cost effective and saves energy.</p>			
Research Questions:			
<ol style="list-style-type: none"> 1) How do we test and measure this technology? 2) Determine an M&V plan with the region 3) Evaluate the field sites - are there energy savings? 4) Could this be a cost effective measure? 5) Should BPA pursue an RTF UES for this technology? 			

BPA Energy Efficiency Emerging Technology 2014 Current Research Project

<u>Focus Area:</u>	Variable Capacity Heat Pump		
<u>Technology:</u>	Ducted Heat Pump		
<u>Project Name:</u>	VCHP Carrier Green Speed - Oak Ridge Labs Coordination		
<u>Sector(s):</u>	Residential		
<u>BPA Project Manager:</u>	Kacie Bedney	<u>Partners:</u>	EPRI Oak Ridge National Lab
<u>Project Start Time:</u>	10/15/2012	<u>Project End Time:</u>	3/31/2014
<u>Project Energy Savings:</u>	30 aMW	<u>Technology Roadmap:</u>	Residential HVAC
Last Updated: 09/2013			
Project Description:			
<p>This project seeks to provide new insight and data on the operation of variable speed heat pumps in typical homes. The project will assess the ability of one type of ducted variable speed system, the Carrier Green Speed, in a controlled field setting at the TVA Campbell Creek research campus.</p> <p>The Oak Ridge National Lab research campus consists of three lab houses that use simulated occupancy to allow direct comparison of different technologies and building techniques. The data and analysis are expected to inform the energy efficiency, design and load management industries to allow them to better apply the technology.</p>			
Research Questions:			
<ol style="list-style-type: none"> 1) Assess the kWh & kW savings potential of a VCHP sized for maximizing winter heating load coverage. 2) Assess the impact of variable air delivery on the extreme terminal zones and register outlets. 3) Assess the ability of the variable speed system to accommodate load management strategies, including demand response load shedding. 4) Make a connection with TVA, EPRI and ORNL to develop possible future residential home field studies with simulated occupancy. 			

BPA Energy Efficiency Emerging Technology 2014 Current Research Project			
Focus Area:	Energy Management		
Technology:	Behavior Based Energy Efficiency		
Project Name:	Snohomish PUD and Starbuck Energy Management Field Test - Phase I		
Sector(s):	Commercial		
BPA Project Manager:	Summer Goodwin	Partners:	Snohomish PUD Starbuck PECI Lucid
Project Start Time:	2/1/2012	Project End Time:	2/1/2015
Project Energy Savings:	100 aMW	Technology Roadmap:	
Last Updated: 09/2013			
Project Description:			
<p>Snohomish County Public Utility District's pilot will test behavior change in the commercial sector. A solution for this sector would be highly attractive to utilities with small commercial facility end-users, which represent a significant untapped energy savings resource with unique barriers to participation behavior change programs. The pilot project is a joint venture between Snohomish County Public Utility District, PECI, Lucid, and Starbucks. The pilot will be implemented at several Puget Sound area Starbucks stores and involves providing staff with frequent energy use data and between-store competitions. If successful, the approach could be scaled to similar facilities across the region. Starbucks has over 700 stores in Washington, Oregon, Idaho and Montana.</p>			
Research Questions:			
<p>1) Will proven strategies from residential behavioral programs provide savings in a small commercial application?</p>			
<p>Improvement on previous work: Very little work has been done in the small commercial arena and no pilots have been done with a large chain, such as Starbucks.</p>			

BPA Energy Efficiency Emerging Technology 2014 Current Research Project			
Focus Area:	Energy Management		
Technology:	Behavior Based Energy Efficiency		
Project Name:	Snohomish PUD and Starbuck Energy Management Field Test - Phase II		
Sector(s):	Commercial		
BPA Project Manager:	Summer Goodwin	Partners:	Snohomish PUD Starbuck PECI Lucid
Project Start Time:	1/30/2013	Project End Time:	9/30/2014
Project Energy Savings:	100 aMW	Technology Roadmap:	
Last Updated: 09/2013			
Project Description:			
<p>Snohomish County Public Utility District's Phase II study: The Community Energy Challenge will center on a single business district within SnoPUD's service territory. The Challenge will involve 10 - 20 businesses to form two teams and compete in a 4-6 month energy reduction challenge. The project has targeted a 10% energy savings for participating businesses. Three elements will be used to influence behavior: public facing energy dashboards; an awareness campaign and an inter-business competition. An evaluation is proposed at the end of the project.</p>			
Research Questions:			
<p>1) Will it be possible to replicate the savings produced in Phase I to a community of businesses?</p>			
<p>Improvement on previous work: Moves beyond a single company to a community of businesses and engages the community with a public facing competition information and an awareness campaign</p>			

BPA Energy Efficiency Emerging Technology 2014 Current Research Project

Focus Area: Energy Management			
Technology:	Behavior Based Energy Efficiency		
Project Name:	Clark PUD – Combining OPower Home Energy Reporting and Social Media Applications		
Sector(s):	Residential		
BPA Project Manager:		Partners:	Clark PUD OPower
Project Start Time:	03/01/2012	Project End Time:	09/30/2014
Project Energy Savings:	100 aMW	Technology Roadmap:	
Last Updated: 09/2013			
Project Description:			
<p>This project seeks to determine the incremental energy-saving impact of "Social Energy" - an energy efficiency social media application. Social Energy users enables users to compare their energy use to a self-defined group. This Social Energy Campaign is experimental. Clark is one of a few utilities testing this approach. This study will combine the Social Energy media application along with O Power's Home Energy Reporting Program. Clark will send Home Energy Reports (HERs) to 20,000 customers while engaging 10,000 of these customer through Social Energy. This application will allow Clark's customers to create their own online efficiency communities. The project has been implemented and the next step will be to conduct an evaluation program during 2014 to understand the program's impact to energy savings.</p>			
Research Questions:			
<p>1) Does the combination of the O Power's HERs and the Social Energy social media application create incremental energy savings impacts?</p> <p>Improvement on previous work: Testing this application with a smaller NW utility and understanding what level of effort is involved in launching this type of program as well as determining the savings impact.</p> <p>Evaluation to be completed in 2014.</p>			

BPA Energy Efficiency Emerging Technology 2014 Current Research Project			
Focus Area:	Energy Management		
Technology:	Behavior Based Energy Efficiency		
Project Name:	Cowlitz PUD OPower Study Advanced Digital Feedback and Communication Campaign		
Sector(s):	Residential		
BPA Project Manager:	Summer Goodwin	Partners:	Cowlitz PUD OPower
Project Start Time:	3/1/2012	Project End Time:	9/30/2013
Project Energy Savings:	100 aMW	Technology Roadmap:	
Last Updated: 09/2013			
Project Description:			
<p>Cowlitz PUD in conjunction with O Power is conducting research to determine the incremental energy-saving impact of an Advanced Digital Feedback and Communication Campaign in addition to O Power's Home Energy Reporting Program. Cowlitz will send 25,000 Home Energy Reports (HERs) to their customers while engaging 12,500 of them through an Advanced Digital Campaign using high usage alerts and email messaging. The HERs program uses billing data, census data and other information to create a "neighbor to neighbor" billing comparison to try and change human behavior resulting in kilowatt hours saved. The hypothesis is that the customer will be moved to use less energy, operate their home more efficiently or to make no-cost, low-costs or deemed measures changes in their home if they can compare their usage with "like" customers. The Advanced Digital Campaign is experimental. Cowlitz is one of just a few utilities testing this approach. Research results will be available in August of 2013.</p>			
Research Questions:			
<ol style="list-style-type: none"> 1) Does the combination of high usage alerts and email messages produce higher energy savings over just the HERs reports? 2) Would like to understand the level of effort it takes to launch this type of project. 			
<p>Improvement over previous research: Cowlitz has AMI and will be able to provide 24 hour interval data making this first time in the Northwest that HERs has been combined with interval data.</p>			

BPA Energy Efficiency Emerging Technology 2014 Current Research Project			
Focus Area:		Lighting	
Technology:		Lighting	
Project Name:		SCE - CLTC Lighting Controls Occupancy/Vacancy Study	
Sector(s):		Commercial	
BPA Project Manager:	Levin Nock	Partners:	California Lighting Technology Center (CLTC) at University of California at Davis Southern California Edison (SCE)
Project Start Time:	06/01/2012	Project End Time:	6/30/2014
Project Energy Savings:		Technology Roadmap:	General Lighting
Last Updated: 09/2013			
Project Description:			
<p>In response to increased use of adaptive, exterior lighting products, and their potential for substantial energy savings, utilities are interested in creating a deemed incentive program focused on this technology. A simplified method is necessary to easily calculate expected energy savings and associated incentives. Energy savings for adaptive luminaries is clearly tied to occupancy patterns. To support a deemed incentive program, standardized occupancy profiles for a variety of nine key non-residential exterior spaces will be developed. These profiles may be used to easily calculate expected energy savings and associated incentives for a proposed adaptive, exterior lighting project.</p>			
Research Questions:			
<ol style="list-style-type: none"> 1) What is the occupancy/vacancy pattern for the nine building types? 2) How does the rate vary across the different types of buildings? 3) What are the variables that impact the occupancy/vacancy? 			

BPA Energy Efficiency Emerging Technology 2014 Current Research Project			
Focus Area:	Agricultural Irrigation		
Technology:	Low Energy Precision Application Irrigation		
Project Name:	LEPA – Low Energy Precisions Application Irrigation		
Sector(s):	Agriculture		
BPA Project Manager:	Dick Stroh	Partners:	Washington State University Idaho University
Project Start Time:	02/15/2012	Project End Time:	02/15/2015
Project Energy Savings:	30 aMW	Technology Roadmap:	
Last Updated: 09/2013			
Project Description:			
<p>Low Energy Precision Application (LEPA) systems consist of pivots where the drops extend to, or nearly to the soil surface. The water is emitted under very low pressures directly onto the soil surface. Although LEPA is wide spread in Texas, Oklahoma and Kansas, it is seldom if ever seen outside of this limited area. This is due to a lack of knowledge about the systems, and negative experiences from short term trials that failed to properly prepare for, and apply best management practices to mitigate runoff issues.</p> <p>This study is a multi-state demonstration project to introduce this technology to the Pacific Northwest and demonstrate how to mitigate run-off issues. The project goals are to:</p> <ol style="list-style-type: none"> 1. Evaluate the viability of LEPA technology in the Northwest 2. Develop criteria for determining where LEPA will work 3. Demonstrate this technology and educate growers on its benefits and how to use it correctly <p>Results from the study will be shared in 2015.</p>			
Research Questions:			
<ol style="list-style-type: none"> 1) Assess the performance of the LEPA technology in the NW. 2) Determine the variables that impact performance. 3) Determine the barriers for adoption of the technology. 4) Evaluate and recommend next steps. 			

BPA Energy Efficiency Emerging Technology 2014 Current Research Project			
Focus Area:	Engine Generator Block Heaters		
Technology:	Engine Generator Block Heaters		
Project Name:	Field Test for Engine Generator Block Heaters		
Sector(s):	Commercial		
BPA Project Manager:	Mira Vowles	Partners:	Flathead Electric Coop Inc. Ravalli County Electric Coop. City of Cheney Kootenai Electric Coop Inc.
Project Start Time:	04/15/2012	Project End Time:	12/31/2013
Project Energy Savings:	2 aMW	Technology Roadmap:	Heating and Cooling Production and Delivery
Last Updated: 09/2013			
Project Description:			
<p>The goal of the project is to develop a BPA Qualified, multiple RTF Unit Energy Savings measures or a plan for an evaluated program. The project will "mine" existing EGBH installations to develop a site-based savings estimates, a better understanding of key variables having the most affect on energy savings and an M&V protocol. The motivation for the project is driven by the significant savings achieved on a custom project, by this new product, the potential for repeatable savings and the ease of adoption for this technology. This project will streamline the incentive program for the EGBH circulation pump installation and develop a standard M&V protocol for EGBH.</p>			
Research Questions:			
<p>1) What are the key variables affecting baseline energy use? 2) How do savings vary with outside air temperature? 3) What is the range of installed costs?</p>			